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HYDROELECTRIC DEVELOPMENT IN JAPAN

FEDERAL WATER POWER LEGISLATION
BY HENRY J. PIERCE.

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Alphabetical Index to Advertisers, Page 8 · Where to Buy It in the West, Page 9

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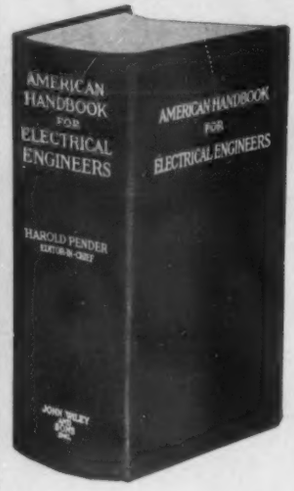

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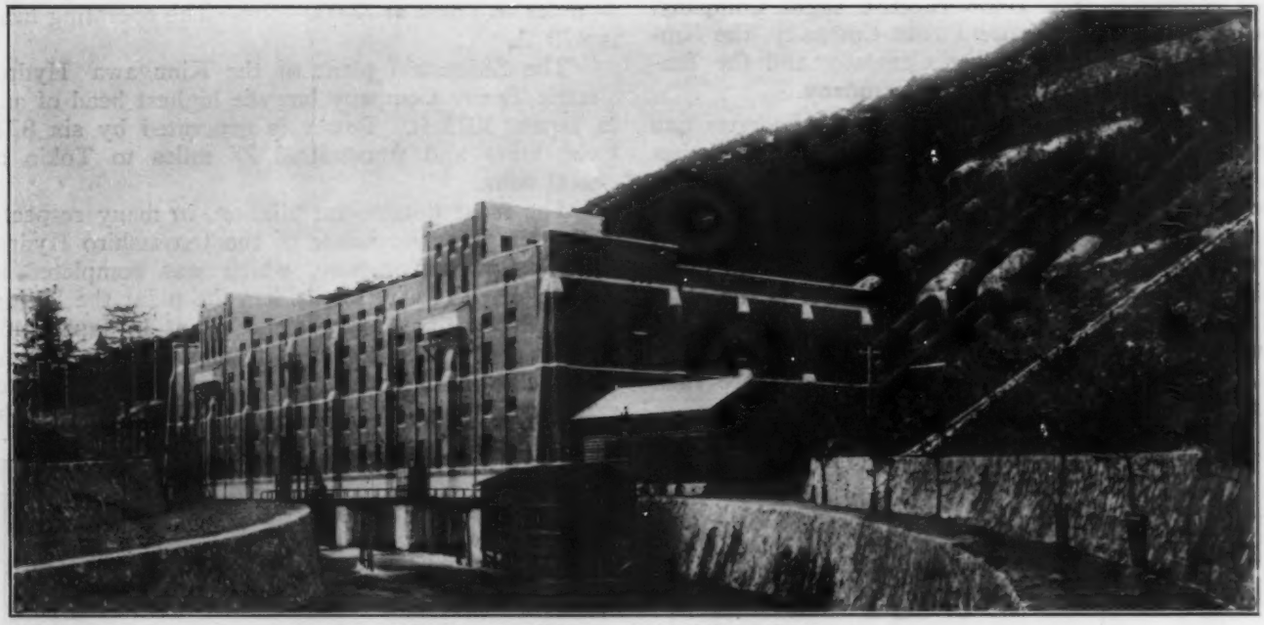
HYDROELECTRIC DEVELOPMENT IN JAPAN

The electrical development of Japan has been one of the most remarkable features of the past decade. Whereas the census returns show that the electrical industry doubles itself every five years in the United States, it has nearly quadrupled itself every five years in Japan. In 1903 the installed capacity was 80,269 kw., in 1908 it was 369,180 kw., and in 1913 it was 1,021,732 kw. It is noteworthy, furthermore, that the proportion of hydroelectric to steam, gas and oil power has increased from less than one-half the total power developed in 1903, to more than two-thirds the installed capacity in 1913. There are over six hundred electric power plants of all descriptions in Japan, this number being about equally divided between water power plants and steam, gas and oil power plants.



Uji Plant of Ujigawa Hydroelectric Power Co.

Geographically speaking, Japan consists of a long, narrow chain of volcanic islands extending from northeast to southwest and traversed from end to end by a dominating mountain range with numerous branches. As a consequence most of the streams have small drainage areas, short courses and steep gradients. Many of them are well adapted for power development, low heads being the rule.

Most of the power plants cluster around the centers of population, particularly Tokio, Osaka and Kioto. The equipment, as a rule, is of Swiss, German or English manufacture, though there is a growing tendency to adopt American practice, particularly as regards transformers and switching equipment, together with transmission towers and insulators. The Japanese, however, are rapidly becoming skillful in the manufacture of electrical apparatus and undoubtedly will soon be able to supply a large part of their local demand. They are already manufacturing high tension porcelain insulators.

The power consumption has kept close pace with the supply. For each five year period since 1903 it has been more than quadrupled in amount, as can be seen from the following tabulation:

Vatsuzawa Plant of Tokio Electric Light Co.

Year.	Connected Lamps.	Connected Motors.	Electric Cars.
1903	365,090	4,107 h.p.	344
1908	1,230,876	17,093 h.p.	1,600
1915	6,148,420	107,273 h.p.	3,990

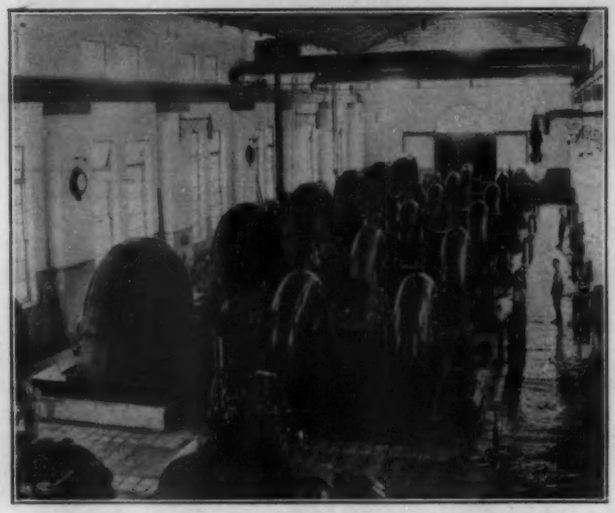
Hydroelectric power is transmitted to Tokio by four companies, the Tokio Electric Light Company, the Katsuragawa Electric Power Company, the Kinagawa Hydroelectric Power Company and the Inawashiro Hydroelectric Power Company.

The Tokio Electric Light Company operates two hydroelectric plants, one at Vatsuzawa and the other at Komakaski, 39 and 44 miles respectively from Tokio power being transmitted at 55,000 volts in each case. The former plant has been in service since July, 1912, there being six 7700 k.v.a. turbo-generators operating under a head of 379 ft. The other is the older plant, dating from 1907 and containing six 3300 k.v.a. Escher-Wyss & Company units operating under a 385 ft. head. This company supplies more than three-fourths of the lighting and power consumers of the city as well as the municipal lighting. The rates are about the same as in the larger American cities.

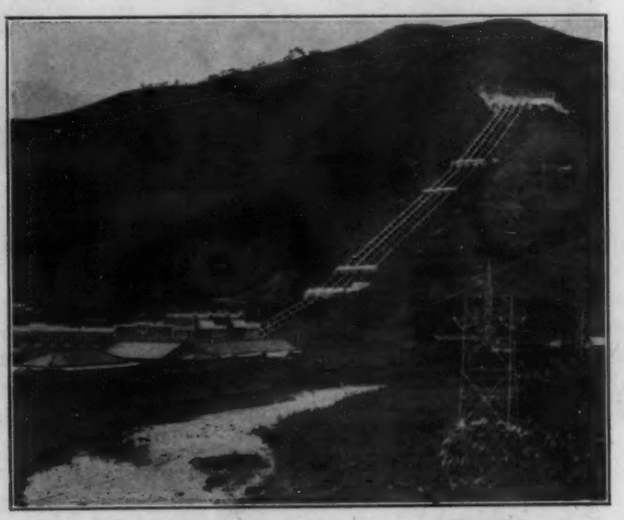
Since June, 1913, the Katsuragawa Electric Company has been operating four 7000 k.v.a. units in its Shishidome plant, from which power is transmitted 64 miles to Tokio at 77,000 volts. The operating head is 470 ft.

The Shimotaki plant of the Kinugawa Hydroelectric Power Company has the highest head of any in Japan, 1025 ft. Power is generated by six 8700 k.v.a. units and transmitted 77 miles to Tokio at 77,000 volts.

The most notable installation, in many respects, is the No. 1 power house of the Inawashiro Hydroelectric Power Company, which was completed in November, 1914. Not only has the plant the largest installed capacity of any single plant in Japan, 46,662, k.v.a., but the power is transmitted the longest distance at the highest voltage. Six 7777 k.v.a. turbogenerators are operated under a 349 ft. head and the

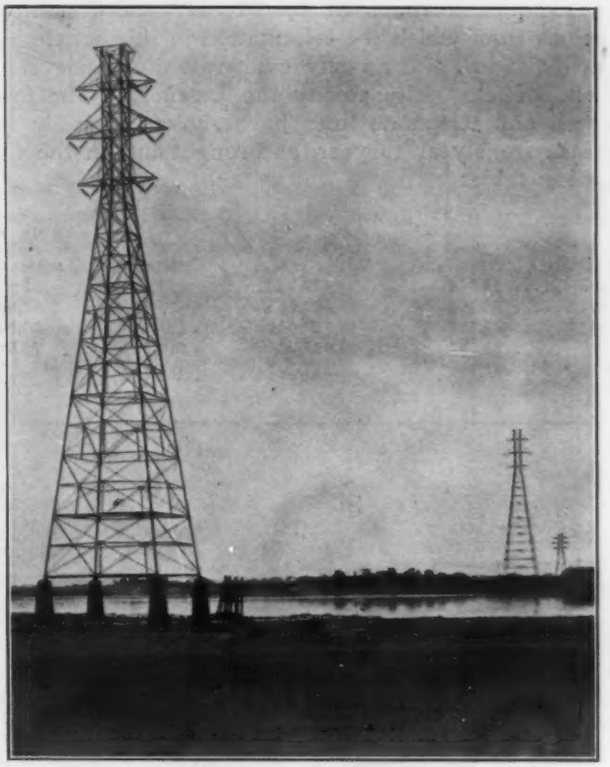


Interior of Komohashi Power House, Tokio Electric Light Co.



Shishidome Plant of Katsuragawa Electric Power Co.

No. 1 Plant of Inawashiro Hydroelectric Power Co.



1530 ft. Span of Inawashiro 115,000 Volt Tranmission Line.

power transmitted 140 miles at 115,000 volts by a double steel tower line. In one place this line has a 1530 ft. span between 220 ft. towers.

This is the first of four eventual developments on the Nippashi River below Lake Inawashiro within a distance of six miles. The six 10,000 h.p. Francis turbines are of German manufacture (J. N. Voith), the generators are of English manufacture (Dick, Kerr & Company), and the 6600/115,000 transformers, high tension switches and lightning arresters of American make (Westinghouse Electric & Manufacturing Company.)

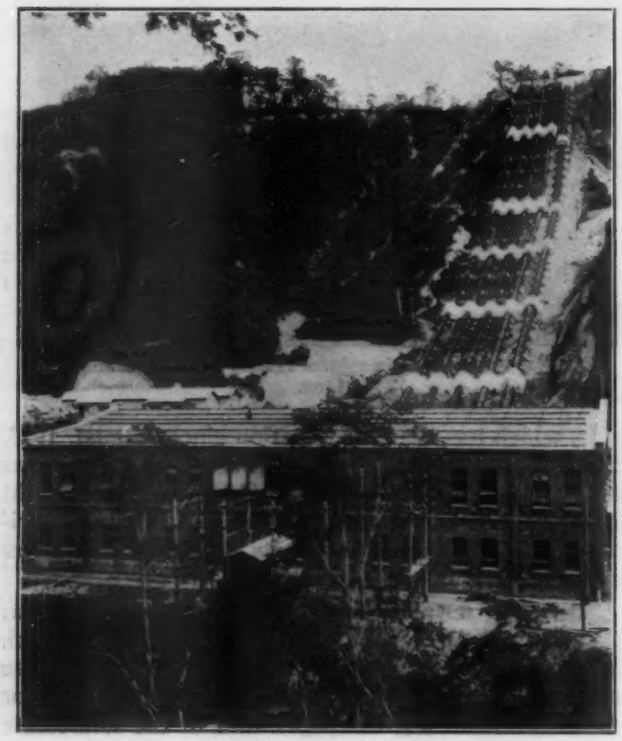
Osaka and Kioto are supplied with hydroelectric power over a 22 mile, 55,000 volt line from the Uji power house of the Ujigawa Power Company. This plant, which has been in operation since August, 1913, has an installed capacity of 22,140 kw. and operates under a head of 203 ft. The Osaka Electric Light Company also supplies 10,000 k.v.a. from two horizontal steam turbine units in its Ajikawa-East power house.

Another notable installation is the 10,000 kw. plant of the Oji Paper Mill Company at Tomokomai, Hokkaido, the northernmost island of the Japanese group. Four 3125 k.v.a. generators supply power for the operation of a great paper mill in the immediate vicinity.

Interior No. 1 Plant Inawashiro Hydroelectric Power Company.

The publications of the Ministry of Communications from which the information in this article has been gleaned, show many evidences of the development of electricity among the Japanese. The telegraph and telephone lines have shown a steady increase from year to year, as brought out in the following table:

	Telegraph.		Telephone.	
Year.	Wire Mileage.	No. of Telegrams.	Wire Mileage.	No. of Sub-stations
1893	25,356	6,490,962	4,400	2,672
1898	52,475	14,973,382	31,282	8,064
1903	84,587	18,753,662	113,415	35,013
1908	99,707	26,955,025	210,186	78,517
1913	111,908	33,218,393	490,959	200,271



Hydroelectric Plant of Oji Paper Mill Co.

All power developments, as well as the postal, telephone and telegraph service, are under the control of the Ministry of Communications which exercises a close supervision over rates, construction and operation. There is a growing sentiment toward public ownership, particularly of electric railway systems. The state already owns the steam railways. Stringent legislation has been provided for the appropriation of land, so that any private land necessary for railways, electrical or gas plants can be condemned or appropriated. The law provides that full compensation be given for lands thus acquired.

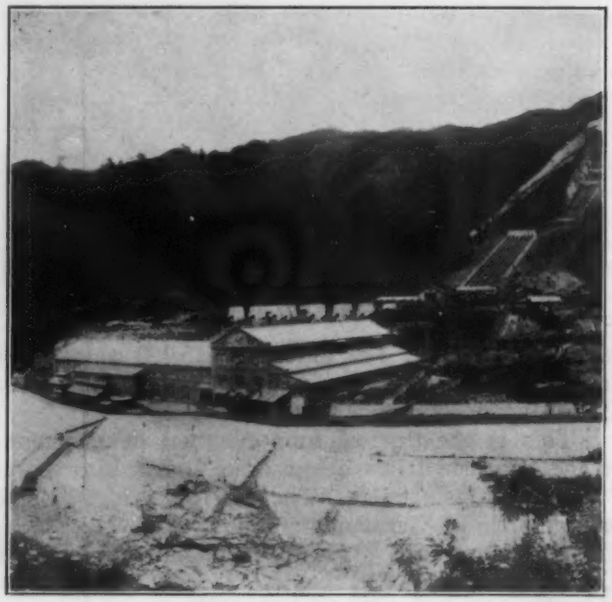
The crushing strength of ice is 363 lb. per sq. in. at a temperature of 0 degrees C., its tensile strength is 120 lb. per in. If ice is firmly frozen to a concrete dam it will develop its full crushing strength, irrespective of the inclination of the line of ice to the surface of the concrete, provided the temperature is below the freezing point.

FEDERAL WATER POWER LEGISLATION.

BY HENRY J. PIERCE.

(After summarizing the action on the water power bills at the last session of Congress the author suggests changes in the Ferris bill which would make it a workable measure. This paper is slightly condensed from a pamphlet which is being circulated by the author, who is a capitalist at Seattle, Wash. —The Editor.)

The non-development of our water powers constitutes one of the strangest features of our national conduct. Water powers are wasting their energy because capital cannot be obtained for their development under the present restrictive federal laws.



Shimotaki Plant of Kinugawa Hydroelectric Power Co.

Under the laws now in force, permits for the development of water power may be revoked at any time by the federal bureau chief having jurisdiction. Capital for development purposes cannot be obtained under this uncertain tenure. All agree that the present laws must be changed, but a difference of opinion exists as to what the terms of the new laws should be. It will not be sufficient to make the tenure of the grant specific and leave the terms to be fixed by the federal bureaus, for their practice in the past indicates that they would impose impossible conditions. Development of water power is a hazardous business. Floods cause dams to burst, lightning plays havoc with transmission lines, public service commissions keep rates down to a level that makes possible earnings not very attractive to the investor. The new federal laws must, while providing proper regulation in the public interest, be specific, certain and clear in their terms, and be of a nature under which capital may confidently invest. Otherwise there will be no development.

The water powers in navigable streams are under the jurisdiction of the War Department, and the water powers in the public domain in non-navigable streams are under the jurisdiction of the Department of the Interior.

Much time and consideration were given by the last Congress to water power legislation. Two bills had passed the House, and were on the Senate calendar when Congress adjourned.

Navigable Stream Water Power Legislation.

The Adamson-Shields bill related to water power developments on the navigable rivers. It was unworkable in the form in which it passed the House, many of its conditions being onerous, restrictive, unbusinesslike and ambiguous. The Senate Commerce Committee, however, crossed out all but the enacting clause and rewrote the bill, making it a practical measure which, while safeguarding the public interest, was satisfactory to the power developer and investor. Under this bill, as amended by the Senate Commerce Committee and known as the Shields Navigable Stream bill, the applicant for a federal permit to develop water power, after complying with state laws, and if his project in the judgment of the Secretary of War would be an aid to navigation, would be entitled to a permit having a tenure of fifty years, with the right to the government to take over the entire property at its fair value at any time thereafter. No government tax was imposed, but the Secretary of War could oblige the permittee to install and maintain locks in the interest of navigation, if thought just and necessary by him. Regulation as to rates and service were left to the state authorities, except as to features relating to navigation, which were considered paramount and were placed under the regulation of the War Department. If this bill had passed, steps would at once have been taken for the development of power on the Columbia and Pend Oreille Rivers in Washington; in the upper reaches of the Mississippi above Minneapolis; on the Connecticut River in Massachusetts, and on the Coosa and Tennessee Rivers in the Southern states. All of these projects are now lying dormant, and must await the passage of federal laws under which it will be possible to obtain capital for development purposes.

Public Domain Water Power Legislation.

Nearly three-fourths of the total available water power in the United States is contained in the far Western states. Aside from the Columbia and its tributaries, these states contain but few navigable streams, and the great proportion of this vast amount of water power is located in the public domain.

The views of the Secretary of the Interior in relation to federal legislation governing water powers in the public domain were embodied in what was known as the Ferris bill, which following extended hearings before the public lands committee, was passed by the House after being considerably amended, and referred to the public lands committee of the Senate. The committee held public hearings extending over a period of two weeks, at which time every phase of the question was carefully gone over. Such authorities on the subject as Gifford Pinchot, Walter L. Fisher, former Secretary of the Interior, and representatives of the Departments of the Interior and of Agriculture testified in favor of the bill, but while as public spirited citizens they had studied the question in an academic way, not one of them had had any practical experience in the development of water power.

A committee from the American Institute of Electrical Engineers; several of the most eminent hydraulic engineers of the country; bankers who make a specialty of water power securities; the Governors of Colorado and Utah; presidents and managers of some of the largest hydroelectric plants in the Western country; business men who wished to develop water powers for manufacturing purposes and for the purpose of reclaiming immense tracts of arid lands by means of pumping plants to be operated by electricity from water powers at present undeveloped; all these men of practical experience, who, under proper conditions, stand ready to furnish the brains and the capital to develop the water powers of the West, testified unanimously against the bill.

It was conclusively proved at the hearing that there was no foundation whatever for the vague charges that had been made that a water power trust existed. It was shown, however, that one of the greatest public benefits resulting from the development of water powers is through the continuity of service and low rates resulting from the segregation of many hydroelectric plants, serving many different cities, towns and farming communities, into one system. This diversity of service also protects the many investors in hydroelectric securities, for poor business in one town which might wreck a local company, would be pretty surely counterbalanced by good business in other communities served by the system.

After the close of the public hearings the Ferris bill was amended by a divided vote and reported to the Senate by the public lands committee, accompanied by a majority and a minority report. The bill as amended and placed upon the Senate calendar was a great improvement on the form of the measure as passed by the House, but contained several defects which would prevent conservative investment, and restrict the healthy growth of the hydroelectric industry.

The following is a copy of the Ferris bill as amended by the public lands committee of the Senate, in which the writer has indicated the omissions and incorporated the changes (in italics) which, in his opinion, are necessary in order to make the bill a workable measure. Even with the changes indicated it is not all that could be desired, but the writer has kept as near the text of the bill as possible, hoping to reach a common ground acceptable to all who have divergent views upon the subject.

Following the text of the bill, the writer gives his reasons why the changes he suggests should be made:

Parentheses denote omissions; italics, additions to the text.

AN ACT

To provide for the development of water power and the use of public lands in relation thereto, and for other purposes. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

That the Secretary of the Interior be, and hereby is, authorized and directed, under general regulations to be fixed by him, not inconsistent with the terms of this Act, to lease to citizens of the United States, or to any association of such persons, or to any corporation organized under the laws of the

United States, or any state or territory thereof, any part of the public lands of the United States (including Alaska), reserved or unreserved, including lands in national forests, the Grand Canyon and Mount Olympus national monuments, and other reservations, not including national parks or military reservations, for a period of fifty years unless the applicant and the Secretary of the Interior agree on a shorter period as the applicant for lease may elect, for the purpose of constructing, maintaining, and operating dams, water conduits, reservoirs, power houses, transmission lines, and other works necessary or convenient to the development, generation, transmission, and utilization of hydroelectric power, which leases shall be irrevocable except as herein provided, but which may be declared null and void upon breach of any of their terms: Provided, That such leases shall be given within or through any of said national forests or other reservations only upon a finding by the chief officer of the department under whose supervision such forest, national monument, or reservation falls that the lease will not injure, destroy or be inconsistent with the purpose for which such forest, national monument, or reservation was created or acquired: Provided further, That in the granting of leases under this Act the Secretary of the Interior may, in his discretion, give preference to applications for leases for the development of electrical power by states, counties or municipalities, or for municipal uses and purposes: Provided further, That for the purposes of enabling applicants for a lease to secure the data required in connection therewith, the Secretary of the Interior may, under general regulations to be issued by him, grant preliminary permits authorizing the occupation of lands valuable for water power development for a period not exceeding one year in any case, which time may, however, upon application, be extended by the Secretary of the Interior if the completion of the application for lease has been prevented by unusual weather conditions or by some special or peculiar cause beyond the control of the permittee: Provided, That no lease shall be granted until the applicant has *presented a certificate from the duly constituted authorities of* the state or states wherein said project is to be located, *specifying that the applicant has acquired or initiated the right under state laws to the use of* sufficient water to develop or generate the electrical energy intended to be generated by applicant's proposed project.

Sec. 2. That each lease made in pursuance of this Act shall provide for the diligent, orderly, and reasonable development and continuous operation of the water power, subject to market conditions.

Sec. 3. That in case of the development, generation, transmission, or use of power or energy under such a lease in a territory, or in two or more states, the regulation and control of service and of charges for service to consumers and of the issuance of stock and bonds by the lessee is hereby conferred upon the Interstate Commerce Commission: (Provided, That the physical combination of plants or lines for the generation, distribution, and use of power or energy under this Act or under leases given hereunder not in violation of law may be permitted, in the discretion of the Secretary of the Interior.)

Sec. 4. That no lessee under this Act shall create any lien upon the land leased nor upon any power project within a territory, or intended for use in the generation and transmission of water power or energy in two or more states and developed under a permit issued under this Act by mortgage or trust deed, except approved by the Inter-State Commerce Commission and for the bona fide purpose of financing the construction or operation of said project. Any successor or assign of such property or project, whether by voluntary transfer, judicial sale, foreclosure sale, or otherwise, shall be subject to all the conditions of the approval under which such rights are held, and also subject to all the provisions and conditions of this Act to the same extent as though such successor or assign were the original lessee hereunder.

Sec. 5. That upon not less than three years' notice, which may be issued at any time after three years immediately prior to the expiration of any lease under this Act, the United States shall have the right to take over all the properties which are dependent in whole or in part for their usefulness on the continuance of the lease herein provided for, which may have been acquired by any lessee under the provisions of this Act, or the right to take over, upon mutual agreement with the lessee, a severable and complete unit of any such power system, upon condition that it shall pay in a lawful warrant drawn on the treasury of the United States, or otherwise, before taking possession the fair value of such property, such value to be determined by mutual agreement between the Secretary of the Interior and the lessee, and, in case they cannot agree, by proceedings instituted in the United States District Court for that purpose: Provided, That such fair value shall not include or be affected by the value of any public lands, rights of way, or other property leased or granted under this Act by the United States or by the value of the franchise, good will, (value as a going concern) future profits from pending contracts, or prospective revenues, profits, or dividends, *or any other element which in the opinion of the courts of the United States or in practice duly established thereunder and approved thereby does not constitute nor represent actual value in said property.*

Sec. 6. That in the event the United States does not exercise its right to take over, maintain, and operate the properties as provided in Section 5 hereof, or does not renew the lease to the original lessee upon such terms and conditions and for such periods as may be authorized under the then existing applicable laws, the Secretary of the Interior is authorized, upon the expiration of any lease under this Act, to lease the properties of the original lessee to a new lessee upon such terms, under such conditions, and for such periods as applicable laws may then authorize, and upon the further condition that the new lessee shall pay for the properties as provided in Section 5 of this Act. In the event the United States does not (exercise its right to take over the properties, as provided in Section 5, and a renewal of the lease to the original lessee is not made, and no lease is made of the properties to a new lessee, then the original lease at the option of the lessee shall continue in existence upon the terms and conditions in force at the time fixed for its expiration until such time as the property is taken over by the United States, as provided in Section 5, or by a new lessee, as provided in Section 6, or the lease is renewed). *At the close of the 50 year lease period provided in Section 1 exercise its right to take over the properties as provided in Section 5, and does not renew the lease to the original lessee and does not lease the properties to a new lessee, then the original lessee shall continue to occupy the property under the terms of the original lease, pending the decision of the United States to take over the property as provided in Section 5 or to transfer the not lease the properties to a new lessee, then the original lessee same to a new lessee, as provided in Section 6*: Provided the original lessee shall have a preference right to renewal over and above any new lessee upon such terms and conditions as the law and regulations then in force shall authorize.

Sec. 7. That where the public interest requires or justifies the execution by the lessee of contracts for the sale and delivery of electrical energy for periods extending (not to exceed twenty-five years) beyond the fifty-year period herein named, such contracts may be entered into upon the approval of the public service commission or similar authority in the state in which the sale or delivery of power is made, and upon the approval of the Secretary of the Interior of the United States; or if sold or delivered in a territory or in a state without a regulating authority, then upon the approval of the Secretary of the Interior; and thereafter, in the event of the termination of the lease as herein provided, the United States or any subsequent lessee shall assume and fulfill all such contracts entered into by the original lessee.

Sec. 8. That for the occupancy and use of lands and other

property of the United States permitted under this Act, the Secretary of the Interior is authorized to specify in the lease and to collect *reasonable* charges or rentals for all land leased, (which charges or rentals may in the discretion of the Secretary be measured by the power developed and sold or used by the lessee for any purpose other than the operation of the plant.) *In case the Secretary of the Interior and the lessee cannot agree, then the District Court of the United States shall determine what the charges or rentals shall be.* And of the proceeds fifty per centum thereof shall be paid by the Secretary of the Treasury after the expiration of each fiscal year to the state within which the hydroelectric energy is generated and developed. The remaining fifty per centum shall be paid into, reserved, and appropriated as a part of the reclamation fund created by the Act of Congress approved June seventeenth, nineteen hundred and two, known as the reclamation Act: Provided, That if leases shall be made of lands within Indian reservations the proceeds of charges or rentals of lands leased which are situated within Indian reservations shall be placed in the treasury of the United States to the credit of the Indians of the reservation in which the lands so leased are situated: Provided further, That leases for the development of power by municipal corporations for municipal use shall be issued without rental charge and that leases for development of power not in excess of twenty-five horsepower may be issued to individuals or associations for domestic, mining, or irrigation use without charge.

Sec. 9. That in case of the development, generation, transmission, or use of power or energy under a lease given under this Act in a state which has not provided a commission or other authority having power to regulate rates and service of electrical energy and the issuance of stock and bonds by public utility corporations engaged in power development, transmission, and distribution, the control of service and of charges for service to consumers and stock and bond issues shall be vested in the Secretary of the Interior or committed to such body as may be authorized by Federal statute until such time as the state shall provide a commission or other authority for such regulation and control.

Sec. 10. That where the Secretary of the Interior shall determine that the value of any lands, heretofore or hereafter reserved as water power sites or for purposes in connection with water power development or electrical transmission, will not be materially injured for such purposes by either location, entry, or disposal, the same may be allowed under applicable land laws upon the express condition that all such locations, entries, or other methods of disposal shall be subject to the sole right of the United States and its authorized lessees to enter upon, occupy, and use any part or all of such lands reasonably necessary for the accomplishment of all purposes connected with the development, generation, transmission, or utilization of power or energy, and all rights acquired in such lands shall be subject to a reservation of such sole right to the United States and its lessees, which reservation shall be expressed in the patent or other evidence of title: Provided, That locations, entries, selections, or filings heretofore allowed for lands reserved as water power sites or in connection with water power development or electrical transmission may proceed to approval or patent under and subject to the limitations and conditions in this section contained, but nothing herein shall be construed to deny or abridge rights now granted by law to those seeking to use the public lands for purposes of irrigation or mining alone.

Sec. 11. That the Secretary of the Interior is hereby authorized to examine books and accounts of lessees and to require them to submit statements, representations, or reports, including information as to cost of water rights, lands, easements, and other property acquired, production, use, distribution, and sale of energy, all of which statements, representations, or reports so required shall be upon oath, unless otherwise specified, and in such form and upon such blanks as the Secretary of the Interior may require; and any person making any false statement, representation, or report under oath shall be subject to punishment as for perjury.

Sec. 12. That any such lease may be forfeited and canceled, by appropriate proceedings, in a court of competent jurisdiction whenever the lessee, after reasonable notice, in writing, as prescribed in the lease, shall fail to comply with the terms of this Act or with such conditions not inconsistent herewith as may be specifically recited in the lease.

Sec. 13. That the Secretary of the Interior is hereby authorized to perform any and all acts and to make such rules and regulations as may be necessary and proper for the purpose of carrying the provisions of this Act into full force and effect.

Sec. 14. That nothing in this Act shall be construed as affecting or intended to affect or to in any way interfere with the laws of any State relating to the control, appropriation, use, or distribution of water.

Sec. 15. That all Acts or parts of Acts providing for the use of the lands of the United States for any of the purposes to which this Act is applicable are hereby repealed to the extent only of any conflict with this Act: Provided, however, That the provisions of the Act of February fifteenth, nineteen hundred and one (Thirty-first Statutes at Large, page seven hundred and ninety) shall continue in full force and effect as to lands within the Yosemite, Sequoia, and General Grant National Parks in the State of California: And provided further, That the provisions of this Act shall not be construed as revoking or affecting any permits or valid, existing rights of way heretofore given or granted pursuant to law, but at the option of the permittee any permit heretofore given for the development, generation, transmission, or utilization of hydroelectric power may be surrendered and the permittee given a lease for the same premises under the provisions of this Act.

Sec. 16. That this Act shall not apply to navigation dams or structures under the jurisdiction of the Secretary of War or Chief of Engineers, or to lands purchased or acquired by condemnation by the United States, or withdrawn by the President under the Act approved June twenty-fifth, nineteen hundred and ten, entitled "An Act to authorize the President of the United States to make withdrawals of public lands in certain cases," where such lands are purchased, acquired by condemnation, or withdrawn by the President for the sole purpose of promoting navigation.

(Sec. 17. That in instances where only five per centum or less of the lands actually necessary and required for the construction, maintenance and operation of dams, water conduits, reservoirs, power houses, transmission lines, and other works for the development, generation, transmission, and utilization of hydroelectric power in any one proposed separate, distinct, and complete plant or project are lands of the United States government and such government lands are to be used only for overflowage, reservoir, or transmission purposes and not in whole or in part as a dam site or the site of a power house nor for the erection of buildings or operation of machinery, the Secretary of the Interior may, in his discretion, lease such lands to an applicant for not more than fifty years, at such rental price and upon such terms as he may deem just, free from all or any other of the terms, conditions, provisions, and requirements of this Act which the Secretary of the Interior may see fit to waive.)

Sec. 18. That authority is hereby conferred upon the state of Colorado or any citizen or citizens directly interested, or both, to institute and prosecute an action at law or in equity against the Secretary of the Interior, or the Commissioner of the General Land Office, or both, to determine its right and the rights of its citizens to appropriate and apply to beneficial uses the waters of the Rio Grande River and its tributaries within its geographical boundaries. Such action may be instituted in the District Court of the United States within the State of Colorado, and any judgment or decree therein shall be subject to review by writ of error or appeal as provided by law in other cases.

Sec. 19. That authority is hereby conferred upon the state of Nebraska or any citizen or citizens directly interested, or both, to institute and prosecute an action at law or in equity against the Secretary of the Interior or the director of the Reclamation Service, or both, to determine its right and the rights of its citizens in and to the water of the North Platte River stored by the Pathfinder Dam in the Pathfinder Reservoir in the state of Wyoming. Such action may be instituted in the District Court of the United States within the state of Nebraska, and any judgment or decree herein shall be subject to review by writ of error or appeal as provided by law in other cases.

Sec. 20. That the lands leased under this Act may be used and the works constructed, maintained, and operated thereon may be used, added to, or enlarged by the lessee or any other person, association, or corporation, for the purpose of impounding and conveying water for irrigation, mining, municipal, domestic, and other beneficial purposes, whenever such use of the water is authorized by the state where said project is situated: Provided, however, That said lands and works are so used by any other than the lessee, such use must be without expense or damage to the lessee, *and shall not be used for power purposes by any other than the lessee.*

Passed the House of Representatives August 4, 1914.

Attest: SOUTH TRIMBLE, Clerk.

H. R. 16673—3.

[To be continued.]

OIL BURING STAND-BY PLANTS.

BY C. H. DELANEY.

[Concluded.]

In the normal operation of the Oakland plant, in addition to the boilers under fire there are nine boilers kept hot ready to generate steam the instant the fires are lighted. Using the above figures, 51.3 lb. per hr. for each McNaull and 24.6 for each Parker boiler, these nine boilers use 381 lb. per hr. or 7240 pounds for the 19 hours the plant is kept in operation. To this must be added about 1200 pounds to cover the warming up of these boilers after their 5 hour shut down, making a total of 8440 lb. or 25 bbl. of oil per day used solely for the purpose of keeping the extra boilers hot. This means a fuel cost of $17.50 per day which could be saved if the stand-by did not involve being ready for full load instantaneously. In addition two extra men are required at the plant on account of the emergency condition, so that there is an expense of $700 per month more for the instantaneous stand-by service than for a service involving only the keeping of the turbine in operation.

It is the keeping of the turbine and its auxiliaries in operation, however, that is by far the largest expense in the operation of these plants. At the Sacramento station, for instance, a careful study of the regular plant records shows that it takes a little less than five barrels of oil for 24 hours to maintain pressure on one boiler and on the steam pipes throughout the station. This is the total fuel expense that would exist at this plant for stand-by if it were possible to give the plant one-half hour's notice when the load is coming on. With the turbine and auxiliaries running at practically no load (less than 200 kilowatts) it requires 5.6 bbl. of oil per hour, which would amount to 135 bbl. in 24 hours if the turbine were kept running continuously as against 5 bbl. when the turbine is kept shut down. It is evident, therefore, that if it were not necessary to keep the machine in operation, the cost of operating the plant could be greatly reduced. It is for this reason that the turbine in the Sacramento plant is operated only at such times as are considered essential for the protection of the service.

In a plant that is strictly a stand-by plant, therefore, the greatest saving can be made by reducing the length of time the turbines are kept in operation. The large quantity of steam used by the auxiliaries in proportion to the amount used by the turbine at loads of 100 or 200 kilowatts makes it very wasteful to operate turbines in this manner. It therefore, appears that the greatest saving in the operation of stand-by steam plants must be made by perfecting the hydro-electric transmission system so as to reduce the number of disturbances and make it entirely dependable for continuity of service.

Assuming, however, that the turbines must be kept operating at speed, some economy can be effected by arranging to give the station notice of when a heavy load will be required; that is to say, if the weather conditions are such that trouble may be expected, the steam stations should be given notice that they may be expected to carry a full load at a certain time. On other days when the weather is good, they should be notified that the load required to be picked up will not exceed a certain minimum quantity.

Economies that can be effected in the steam stations themselves consist mainly in installing apparatus suitable for this type of service. The auxiliaries should be mainly electric driven, so far as is consistent with reliable operation, so as to prevent the waste of exhaust steam when there is not sufficient load to make use of it in the feed water heaters. Steel casings on the boilers seem especially attractive in stand-by plants, as when boilers are kept hot and are not generating steam, the radiation losses are a large proportion of the total losses. Tight dampers should be installed on all boilers, and explosion doors should be provided on the side walls to prevent danger from a possible accumulation of gas in the setting.

Continued watchfulness in the boiler room is essential to secure the highest efficiency. This is true in an oil burning plant as well as in a coal burning plant, and in a stand-by plant as well as in a plant that operates continuously. The operator is sorely tempted to neglect his boiler economies when there is very little load on the plant, because the fuel burned then is so much less than when he does carry a load, but in plants where this condition exists for 90 or 95 per cent of the time, the stand-by losses become the real station losses, and economical operation at fractional loads becomes of prime importance.

An explosion proof motor is defined by the U. S. Bureau of Mines as one "constructed so as to prevent the ignition of gas surrounding the motor by any sparks, flashes or explosions of gas or of gas and coal dust that may occur within the motor casing."

Refillable fuses are to be the subject of an investigation by the U. S. Bureau of Standards at the request of the Underwriters' Laboratories and a manufacturer of such devices who has appealed for a decision on the question whether their use results in any greater fire or accident hazard than the use of other cartridge enclosed fuses. Commencing July 8 a series of hearings will be held at Washington regarding this question.

ELECTRIC LINE DISTRIBUTION CONDITIONS IN THE PACIFIC NORTHWEST.

BY J. C. MARTIN.

[Continued.]

(After describing distribution line conditions in the Pacific Coast states the author shows the hardships entailed by the N. E. L. A. Specifications. This paper was presented at the San Francisco convention of the National Electric Light Association, June 7-11, 1915.—The Editor.)

Distribution Line Conditions.

The early development of the electrical industry was along very low voltage lines and was naturally confined to the densely populated districts of cities because of the possibility of distributing comparatively large amounts of power to the largest number of consumers with the smallest possible investment in copper and pole line equipment. Increasing demands rapidly forced the extension of lines and the use of higher voltages until the most common distribution voltages in use were 2200 and 4000 volts. These voltages probably comprise the greater part of the distribution lines in the United States, and, in the majority of city and town distribution systems may be as high as will be used for some time. The development along low voltage distribution lines has, of course, been confined largely to the densely populated sections of the Eastern states and was followed in the similar sections of the Western states until the demands for power from territory outside the cities and towns of the West became imperative.

Because of the immense water power resources of the Western states and the urgent need of their development, the development of high tension equipment, which would permit wider and more efficient use of these resources, was induced. These influences are as strong today as they have been in the past and call for further development of power distribution practices, particularly in the direction of simplicity and cheapness. The available resources far exceed the demands of the already developed cities and towns. To increase their development, these cities and towns are depending upon the development of the latent resources of the territory. With so large an amount of water power available, the need for power pressing, and the cost of fuel high, the Western states have looked eagerly toward the development of the electrical industry because it only could supply the power that has been so well supplied in much of the territory of the Eastern states by the available cheap fuel.

When the problem of supplying customers scattered over sparsely settled districts of the West was faced, it was at once apparent that none of the common distribution voltages could be used without an excessive amount of copper being required to take care of a small amount of business. To meet the problem, the development of equipment for distribution service has been carried on until we now have available all the necessary equipment for distribution voltages up to at least 15,000 volts. Sixty-six hundred volt distribution lines are in common use all over the Western states where rural territory must be served and many of the lines are so built that when load conditions demand it, they can be readily changed to 11,000 volt Y-connected grounded neutral lines. No argument is needed to prove the expediency or desirability of using these voltages. The fact that hundreds of miles are and have been in extremely successful service for a number of years answers all argument. While it might be contended that 11,000 volts can be considered as the highest permissible voltage for such service, the writer would not care to commit himself to such a statement. At least one large manufacturing company is now including in its standard distribution transformer contracts, transformers up to and including 200 kilovolt-amperes for voltages of as high as 33,000. That developments in this direction have not reached their limit is evidenced by the use of 22,000 volts for rural distribution systems and the increasing tendency to consider even higher voltages in the distribution rather than the transmission class.

Because of the large areas and sparse population, the distribution problem in the Western states is a large one. Initial costs must be low or the lines cannot be constructed with any hope of securing sufficient revenue to justify the investment. In very many cases the return on the investment is uncertain because the present state of development of the industries is such that it is impossible to determine with any certainty the results of future development. In others the extensions are tentative in character, very often being purely temporary because of the nature of the power demands. On many extensions it is necessary that load be developed gradually with the development of the territory. The rate of return in these cases must be slowly developed to a satisfactory point. The conditions are those that would be naturally looked for in a new and rapidly developing country and make all the more imperative the keeping of the first cost of lines to the lowest practicable limit, in order that the losses that cannot be foreseen shall be as small as possible. In addition to these factors the demands upon the industry are less exacting in sparsely settled regions than in those more densely settled, where the development of the industry has reached a point that the rendering of better service than that rendered by older or alternative methods is an important function. A failure to meet a demand because of the excessive investment required means a tract of land or an industry undeveloped. This is not only a distinct loss but the constant repetition of such failures creates a feeling of discouragement that makes the solution of the problem more difficult and that further retards the development of the territory.

To meet the distribution problem the only solution now available is the use of higher voltages and at the present time the problem must be solved by the use of distribution line voltages of from 6600 to at least 15,000 volts. Sixty-six hundred and 11,000 volts probably account for the majority of such distribution lines in use at the present time. Not only are such distribution systems in use in the rural districts, but the smaller towns and cities are also being supplied from them. A high tension substation is ordinarily located at a central point, and the smaller communities and rural districts within a radius of ten to twenty miles may be served from the distribution network that is fed by such a substation. In this way many small communities are served without the expense of constructing high tension line spurs and

high tension substations. Not only is the cost of high tension line construction avoided, but the opportunity afforded to take advantage of the diversity factor of the territory and also to use larger high tension transformers materially reduces the investment in high tension substation equipment. If it were necessary to construct high tension lines and substations for each of these communities, they would go without service because of the excessive investment required to meet their demands. The present status of the distribution problem in the Western states therefore calls for the use of distribution voltages up to and including approximately 15,000 volts in order to economically cover large and sparsely settled areas. These lines must and can be built and operated on the same basis as distribution lines having voltages less than 5000 volts.

Application of Specifications.

Our understanding of the intentions of the original and later committees of the National Electric Light Association, which were responsible for the specifications, is that they were expecting to bring together all the data that could be secured and formulate specifications that would set forth what seemed to be the best current practice. These specifications were to be placed before the members of the association for use as a guide. It was also thought that they would ultimately operate to standardize line construction. That anyone was to be forced to adhere strictly to the provisions of the specifications, under all conditions, was not thought of, as the association possessed no power to make them mandatory. It was probably not even assumed that it was possible to draw a specification that would fit all conditions in all parts of the country. The specifications were to simply set forth the best current practice and the individual companies would be free to adapt them to their own conditions, eliminating such items as were unnecessary and modifying others to suit their own individual needs. With these ideas in mind, the work was done and the specifications presented and published. Naturally, as the bulk of the electrical distribution development work had been done in the Eastern states, the specifications reflected current Eastern practice which was applicable to construction in congested districts where the development had taken place. Development of Western conditions was hardly started and the West was not in a position to even suggest definite lines along which such a specification should be drawn because the problems involved were yet to be developed. As no one was bound to a strict use, or any use, of the specifications, it mattered little at the moment whether they fitted Western conditions or not. They were valuable insofar as they applied and could be ignored where they did not apply. Had the matter ended here, no real objection could have been raised to the work of the committees so long as they continued it, by, from time to time, revising the original specifications and presenting the latest and best practice.

The matter did not end here however. The fact that the National Electric Light Association had presented and approved the specifications was at once accepted by other interests and, later, to some extent by regulatory bodies, as evidence that they were authoritative and should govern all line construction. The crossing construction rules, especially were written into the standard railway and telephone specifications and in many cases where distribution line construction has affected these interests we have been told that, if trouble was to be avoided, we must follow these specifications. The answer to objections that they did not fit conditions and required unnecessary expense was that we should have no objections. They were the official specifications of the National Electric Light Association and represented the very best practice. There have even been cases where we were told, when we objected, that it was questionable if we knew our business. If we did, we would not object—these specifications were the highest authority.

These matters were annoying and in many cases serious, but, until the question was taken up by various regulatory bodies, the most serious phase of the situation did not develop. We have faced in several of the Western states the possibility of having the crossing specifications written bodily into our state laws and only after the most strenuous efforts have we succeeded in having the more burdensome requirements eliminated. We have continually faced the argument that the specifications were approved by our own best authorities and thus, it may be said, were beaten over the head with our own club. This argument has been the hardest to meet as it had back of it the argument that the specifications provided for the greatest measure of safety and our opposition was from selfish motives only.

In this way it can be readily seen that a set of specifications that was originally intended to be an aid, has been used as a club by virtue of the weight of authority given it by the industry.

The Railroad Commission of Oregon, under date of August 29, 1913, issued "General Regulations Governing Overhead and Underground Construction of Telegraph, Telephone, Signal, Trolley and Power Lines within Oregon." These became effective October 1, 1913, and included the National Electric Light Association Crossing Specifications, which were, after a long continued discussion and strenuous objection on the part of other interests, limited in their application to circuits carrying 15,000 volts or more.

The Public Service Commission of Washington supplemented a law governing electrical construction, passed by the State Legislature, in 1913, by adopting, early in the year 1914, a set of crossing rules that, while not identical with the National Electric Light Association specifications, were largely copied therefrom. After a re-hearing they were so modified that in effect they are applicable to lines carrying voltages of 15,000 or over. The modified rules became effective August 14, 1914.

The Public Utilities Commission of Idaho, under date of March 1, 1915, adopted regulations governing the "Construction of Pole, Wire and Cable lines of Telegraph, Telephone, Signal, Electric Power and Other Circuits of Similar Character in the State of Idaho." The crossing specifications included therein are a radical departure from any that have previously been presented in these states and the rules contain the first definite classification of circuits that has been

proposed in our territory. They were adopted by the commission after they had been agreed on by the power, telephone, telegraph, railway and labor interests involved.

In most cases we have been pitted against the bodily adoption of the National Electric Light Association, 1911, "Crossing Specifications" with the 5000 volt limit and have had to combat the weight of authority given them by the association. Some of us have devoted a large portion of our time, during the last two years or more, to this problem, and it has always been a question whether we were to be allowed to develop our industry to meet the demands of our territory, or be confined to the lines along which the industry has developed in the thickly populated sections of the country.

[To be continued.]

EXAMINATION QUESTIONS.

The following questions were asked by the Civil Service Board of Portland, Oregon, in an examination for deputy electrical inspector, held June 1, 1915.

1—(a) Explain briefly the difference between d.c. and a.c. current.

(b) What do you consider the two most important advantages of each.

2—(a) Why is Ohm's law so named?

(b) Give two formulas illustrating same.

3—(a) What is meant by a constant potential system?

(b) Constant current?

4—What power is expended in a lighting current if the ammeter gives a reading of 3.5 amperes and the voltmeter a reading of 112 volts?

5—Show by sketch, method of installation in series, multiple and series multiple incandescent lighting.

6—Draw diagram of wiring for an installation including main line fuses, switch, meter loop (a.c.) and seven branch circuit cutout, main line switch to be shown partly open.

7—What size service wires would be required for an installation consisting of 55 lighting circuits, 4-220 volt, d.c., ¾ h.p. dumb waiter elevators and 1-5 h.p. passenger elevator?

8—(a) What is a motor generator and for what used?

(b) Explain fully why a synchronous motor is so named.

9—(a) What is the purpose of a fuse?

(b) How would you distinguish between 250 and 600 volt fuses?

10—Show by a diagram how you would require a service for 1000 amperes to be installed in the a.c. district in a 3 inch conduit.

Practical Questions (Ordinances).

1—(a) What are the ordinance requirements for installations of wires in conduit carrying a.c. current?

(b) Where is conduit required in the City of Portland? Answer fully.

2—(a) How many sockets or receptacles are allowed on lighting circuits?

(b) How many on sign circuits? Answer fully.

3—State at least 5 general rules for installation of wires in concealed knob and tube wiring.

4—State 5 principal requirements for wiring of a 2200 volt motor.

5—State the proper construction of a wooden cabinet.

6—Where is wood moulding prohibited in the City of Portland?

7—What classes of wiring may be installed in basements of buildings in the outer fire limits?

8—State fully the requirements for service to buildings in the underground district.

9—Under what conditions may the neutral fuse of a wiring system be omitted—and when required?

10—What would you consider is meant by the term "accessible" when referring to service switches or cutouts?

11—What are the requirements for the installation of automatic overload circuit breakers?

12—What size motors are required to be provided with resistance boxes and compensators?

13—Where is slow burning insulation or wire required? Where permitted?

14—What size ground wire and switch is required on a wireless telegraph installation?

15—What are requirements for the installation of low voltage transformers?

1—What size wire will be required to supply a current of 150 amperes to a 220 volt d.c. motor located at a distance of 247 ft. from the center of distribution when the drop in voltage is 4 volts?

2—(a) In a circuit the resistance between two points is .4 ohm. What current will flow with a difference of potential of 110 volts?

(b) What is (1st) the power in watts; (2d) the equivalent in horsepower?

3—What amount of power must be delivered to a 150 h.p. motor in 9 hours, motor rated at 98 per cent efficiency?

4—(a) Explain briefly the difference between a 3 wire Edison system and a 3 wire, 3 phase system.

(b) For what is each used and what are the advantages?

5—(a) What are the advantages of a compound wound generator?

(b) Shunt wound? (c) Series wound?

6—(a) What would be the voltage of a 6.6 ampere series arc circuit of 57 lamps estimating 52 volts at the arc?

(b) What would be the total load on the circuit?

7—Make sketch of a standard type of lightning arrester and show how it is to be attached to the circuit it is designed to protect.

8—Explain in detail how you would determine whether a machine is a direct or alternating current motor. whether it is a shunt or compound wound motor; whether it is a synchronous or induction motor.

9—Give the standard symbols for indicating electric outlets on plans as adopted by the National Association of Electrical Contractors for the following:

(a) Ceiling outlet—electric only;combination.

(b) Wall outlet; floor outlet; drop cord outlet.

(c) Single pole switch outlet; 3-way switch outlet.

(d) Arc lamp outlet; base plug outlet.

10—Give a circuit diagram showing the proper wiring to control one set of lights from four different points in the building, wiring to comply with the requirements of the N. E. Code rules.

In a statement of not to exceed 300 words tell how you would proceed to make an inspection of an installation of a four story apartment house from first inspection to final O.K. for service and certificate of final inspection. What would you do if the installation was first class but varied slightly from the requirements in minor details?

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CONTENTS

Hydroelectric Development in Japan 1

The Crushing Strength of Ice 4

Federal Water Power Legislation 4
By Henry J. Pierce.

Oil Burning Standby Plants 8
By C. H. Delaney.

An Explosion-proof Motor 8

Refillable Fuses 8

Electric Line Distribution Conditions in the Pacific Northwest 9
By J. C. Martin.

Examination Questions 11

Editorial 12
Pacific Opportunities.
New Method of Distributing Overhead Costs.
Danger of Over-Centralization of Power.

Personals 14

Meeting Notices 14

News of California Railroad Commission 15

News of Idaho Public Service Commission 15

Trade Notes 15

Industrial 16

New Catalogues 16

News Notes 17

Pacific Opportunities

Many readers may be surprised at the wonderful expansion which has taken place in the hydroelectric industry of Japan during the past decade, as shown in the leading article of this issue. Marvelous as has been this growth it is only indicative of what remains to be done in other countries whose shores border the Pacific. China and South America have even greater natural resources than Japan. The resourceful Japanese however has utilized his resources. The power sources of this island kingdom have been as intensively cultivated as the agricultural possibilities. The same opportunities exist elsewhere in the two continents and the great islands of the Pacific Coast.

China is the most attractive field at present. Power, fuel and agricultural opportunities await only the awakening of the Chinese people to the value of their birthright. Once these millions have been educated to the advantages of electricity, the demand will be sufficient to warrant the construction of great power plants. Certain favored localities can be supplied from hydroelectric plants, but the most promising future would seem to exist for steam turbine plants located at the coal mines.

South America is now the Mecca for many men of initiative. Not only are there great undeveloped resources which are attractive to capital, but much German support has been recently withdrawn because of the war and an opportunity thus afforded to acquire developed enterprises at low prices. The recent commercial congress at Washington has been instrumental in turning North American attention to South American needs and in creating a bond of interest between the two continents.

The Pacific is the ocean of the future. Just as epoch-making events of ancient history were limited to the shores of the Mediterranean, and as modern progress has been fostered in those countries bordering the Atlantic, so will future advancement, commercial as well as electrical, center around the Pacific.

New Method of Distributing Overhead Costs

Most methods of cost accounting are based upon the theory that all of the expense, including the overhead, must be carried by the output, however small. The sophistry of this reasoning is not apparent during good times when production is normal. But during slack times, such as followed the outbreak of European hostilities, smaller production apparently means higher unit costs. At least this is the conclusion presented by the accountant and it has remained for an engineer, Mr. H. L. Gantt, well known because of his efficiency work, to devise a logical solution in a paper entitled "The Relation Between Production and Costs," presented at the spring meeting of the American Society of Mechanical Engineers.

By employing the illustration of separate plants, so ably used by Mr. F. G. Baum in his argument on rates for electric service, Mr. Gantt demonstrates that the expense of an idle plant, or part thereof, might more than offset any profit made by a going plant. From this argument he deduces the following general principle:

The indirect expense chargeable to the output of a factory bears the same ratio to the indirect expense necessary to run the factory at normal capacity, as the output in question bears to the normal output of the factory.

Any remaining undistributed expense, should the factory be running below its normal capacity, is charged to profit and loss, the loss of maintaining a certain portion of the factory idle. Thus, while the method of accounting does not change the fact that there is no profit, it at least shows where the expense properly belongs. As long as there is no change in the method of manufacture, costs should be uniform. Yet the old method of accounting whereby the overhead is divided into the output, shows an increase in cost with decrease in output.

Mr. Gantt points out that the attempt to make a product bear the expense of a plant not needed for its production is one of the most serious defects in our industrial system. It has been responsible for much of the confusion about costs and has lead to uncertainty in business policies.

If the "overhead" is figured on the basis of the normal capacity of the plant, it becomes a fairly constant quantity. "Costs are valuable only as comparisons, and comparisons are of little value unless we have a standard, which it is the function of the engineer to set." By means of this definite and reliable cost method it is possible to distinguish between what is lost in manufacturing and what is lost in business, and thus determine the proper business policy.

This criticism is not directed against the manufacturer or the contractor, but against his accountant, whose function is to present facts for the guidance of his employer. A decrease in overhead is always the first corrective applied to a decrease in output. But when the overhead has reached the irreducible minimum, when the standard cost of production is known, then any losses resulting from further decrease in output should be accounted for as profit and loss and not as rising cost of production.

The Dangers of Over-Centralization of Power

Many a patriotic citizen has been unduly alarmed by the suggestion of possible national separation implied by the term "states' rights" now so freely employed by those engaged in an effort to make possible the development of the water power which now goes idly to the sea. The use of this term is perhaps unfortunate because it is associated with those causes which led up to the Civil War. But in connection with the utilization of wasting water this term has no such meaning. Those who employ the argument are the most ardent believers in the integrity of the Union, and the most sincere workers in endeavoring to maintain it.

To the American sentiment of independence and freedom there is, however, nothing more repugnant than autocracy, unrestricted and irresponsible government. This nation owes its existence to opposition to this principle and European governments may yet owe their re-organization to encouragement of a too strongly centralized government.

In the past the aim of the conservationist has been to concentrate control of the country's water power in a bureau at Washington, D. C. On the plea that the people of the West, particularly, are not able to take care of their national resources, they are urged to place them in the care of the politicians in Washington. These self-same conservationists have tried to set up an independent sovereignty within each of the Western states. As a result, we have the anomaly of restraint in the development of state-owned water which happens to flow past federal-owned lands. Under such circumstances a halt has been called in the beneficent utilization of water power and capital is being diverted into other channels.

Some of the largest financial houses of the country have already organized international departments and are now acquiring public utilities in foreign countries, instead of developing them here. South America, especially, offers many opportunities since German money has been withdrawn for use at home. If proper encouragement had been given to this capital in the past much of it might now be devoted to the development of local enterprises. The fact that millions of dollars which might have been expended on Western mining, irrigation and power plants is being diverted to similar enterprises in Brazil, Bolivia and Peru, will eventually react on the industrial progress of the United States.

Much of this might yet be obviated by a distribution rather than a centralization of political power. The recent tendency of the national government has been contrary to the representative principles upon which it was founded. Commissions contend with commissions as to which is to control the business of the nation. The railroads have almost been regulated out of existence, and a similar fate threatens other classes of business unless a different course is pursued in the future.

The first step in such a change in course should be the delegation to the state of control over such matters as are primarily of local concern. Individual enterprise and industry should be encouraged. California, Oregon or Washington, for example, are not seeking greater powers of self-government, but merely desire to be insured of the continuance of the same powers that are guaranteed under the constitution.

A succinct summary of the water power situation to date appears elsewhere in this issue, together with suggested changes in the amended Ferris Bill so as to make possible the development of non-used waters. Needed legislation will undoubtedly be enacted at the next session of Congress. But before a complete understanding can be reached it seems to be necessary for the issue to become a popular one.

Five years ago this journal pointed out the necessity for educating the public in this matter rather than attempting to first have laws made and then have the reasons given publicity afterwards. If the course of free, frank and open publicity had been pursued many of the present difficulties might have been avoided. And today the only way to insure adequate legislation is to teach the people how their personal interests are being injured by the over-centralization of power.

Centralization of power means bureaucracy, rigid and arbitrary routine government. Its chief duty seems to be the invention of ways and means of perpetuating itself. It is characterized by inelasticity, economic waste and inefficiency, and as such should have no place in representative American government.

PERSONALS

K. G. Dunn of Hunt, Mirk & Company, San Francisco, is on a business trip to San Diego.

J. C. Limegrover of the Selma Electric Company, Selma, Cal., was a recent visitor at San Francisco.

H. W. Stitt, assistant city electrician, Fresno, Cal., spent a few days during the week at San Francisco.

W. A. Rode has charge of the new office of the Power Equipment Company in the Central Building, Seattle.

Ross Hartley, district manager Pacific States Electric Company, Portland, Ore., was a visitor at San Francisco last week.

W. S. Heger, Pacific Coast manager of the Busch-Sulzer Diesel Engine Company, San Francisco, is on a business trip to Los Angeles.

W. S. Greenfield, manager of H. W. Johns-Manville Company, San Francisco, left the first of the week for a trip to southern California.

A. A. Brown, assistant to sales manager Westinghouse Electric & Manufacturing Company, New York, is a visitor at San Francisco.

W. C. Hough of the State Department of Engineering, Sacramento, Cal., spent a few days last week on a business trip to San Francisco.

Jas. F. Rogan, Southern California manager of the Edison Storage Battery Company, is at Chicago, attending the advertising men's convention.

T. H. Aldridge, city engineer at Shanghai, China, is at San Francisco in connection with the extension of the Shanghai lighting system.

Thos. Mirk, president of Hunt, Mirk & Company, San Francisco, returned the latter part of last week from a business trip to Los Angeles.

Geo. W. Murray, chief electrician, mechanical department, San Pedro, Los Angeles and Salt Lake Railroad, Los Angeles, spent a few days at San Francisco on business of the company.

N. Werner, formerly of the sales force in the Sacramento Valley, California, of the Pacific States Electric Company, has resigned to become associated with J. C. Broili of the Nevada Machine & Electric Company, Reno, Nev.

J. G. Monahan has opened offices in the San Fernando building, Los Angeles, under the firm name of Engineering & General Supply Company, handling the Sangamo meters, Moloney transformers and Biddle scientific instruments.

W. D'A. Ryan, chief illuminating engineer of the General Electric Company, Schenectady, N. Y., and in charge of the illuminating features of the Panama-Pacific International Exposition, San Francisco, is on a business trip to New York.

J. H. Sroufe, Portland, manager for NePage, McKinney & Company, will attend the meeting of the National Electrical Contractors' Association at San Francisco, July 17th, as delegate from the Oregon Electrical Contractors' Association.

Harris J. Ryan, professor of electrical engineering at Stanford University and honorary vice-president of the American Institute of Electrical Engineers, is attending the annual convention of the Institute at Deer Park, Md., as the representative of the San Francisco Section.

Allen E. Ransom has again joined the Seattle organization of the Westinghouse Electric & Manufacturing Company after an extended absence during which he was manager of the Seattle office of the Caldwell Machinery Company and later manager of the engineering department of the Hallidie Machinery Company.

L. Jorgensen, who for the past eight years has been associated with the engineering firm of F. G. Baum & Company of San Francisco, has resigned and will hereafter engage in general electric and hydraulic engineering practice, specializing in the design of arch dams. Mr. Jorgensen will have an office in the Chronicle Building, San Francisco.

Thomas G. Ashton, claim agent of the Washington Water Power Company at Spokane, Wash., was elected president of the Pacific Coast Claim Agents' Association during its seventh annual convention at San Francisco, June 24, 25 and 26; **Thomas A. Cole** of Los Angeles, **W. H. Moore** of San Diego, and **J. S. Mills** of Oakland were elected vice-presidents, and **H. G. Winser** of Tacoma, secretary-treasurer. The next convention will be held at Seattle.

MEETING NOTICES.

Portland Electric Vehicle Association.

Portland Section of the National Electrical Vehicle Association of America has been formed, with Mr. Will Spaulding president; Mr. N. A. Stanton, vice-president, and Mr. George Beazow, secretary.

The Jovian Electrical League of Southern California.

At the meeting at Christopher's on June 23rd, presided over by Tribune J. Harry Pieper, Geo. B. Muldauer, manager of field co-operation for the Society for Electrical Development, spoke briefly on the work of the society. The chairman of the day, an electrical antiquity of the city, Arthur St. Clair Perry, Sr., then presented a number of musical stars, nearly all recruited from the ranks of the electrical industry. S. H. Perrine and G. L. Patterson rendered a cornet due, accompanied by Mrs. Perry, followed by Miss Guelph McQuinn, who played "The Butterfly" on the piano. Rev. Dr. Baker P. Lee, known as the original purveyor of pep, then delighted the audience with a stirring address on "A Man's Man."

Contractors-Jobbers Meeting.

The regular monthly meeting of the electrical contractors and jobbers of the San Francisco Bay region was held at Oakland, June 18th, with an attendance of 81. Vice-President L. B. Gilpin acted as chairman of the meeting, first introducing H. C. Reid of the Pacific Fire Extinguisher Company, who read an interesting paper about what the association is accomplishing in San Francisco, including assistance in the preparation of a new ordinance providing a high license and possibly examination for master electricians. He also discussed general advantages of association membership, as did likewise W. L. Goodwin, Norman Ellis, W. S. Berry, B. C. White, R. D. Holabird and C. C. Hillis. H. McClaren told how the contractor could tie in with the successful "Home Electrical Exhibit" at the Exposition. C. V. Schneider and Mr. Brockaway told of the work at Sacramento and Geo. King of the work in Oakland. C. F. Butte stated that the difficulty of a young man getting into the electrical union and their consequent entrance into the contracting field, would indicate the necessity of their being made apprentices. W. S. Hanbridge closed the meeting by a brief statement of the growth of the association.

Electrical Development and Jovian League.

As the June 23rd meeting concluded President Leggett's administration, a large and enthusiastic bunch were present as a token of appreciation of his efforts. The reports of the president and treasurer showed that the league had rounded out the most successful period of its existence. President Leggett expressed his appreciation of the support given him by the officers and members, particularly that of A. H. Halloran, who, as chairman of the Live Wire Committee, was credited with having done much to promote interest and attendance at the meeting. The following officers were elected for the new term, with meetings commencing in September: President, Geo. C. Holberton; vice-president, E. M. Cutting; executive committee, C. C. Hillis, R. M. Alvord, R. F. Behan, L. R. Boynton and E. B. Strong (secretary-treasurer). A vote of thanks was then given President Leggett for his earnest and enthusiastic work. W. S. Berry, as chairman of the day

introduced the Western Electric quartet, who rendered some excellent musical selections, and D. P. Fullerton, general superintendent of plant for the Pacific Telephone & Telegraph Company, who described the construction of the transcontinental telephone line, supplementing his remarks by moving pictures.

Portland Electrical Club.

At the meeting Friday noon, June 25th at the Hotel Benson, the name of the Portland Jovian League was changed to the Portland Electrical Club, by a vote of the membership, after this action had been recommended by the executive committee. The president appointed the following nominating committee: Messrs. Boring, Henkle and Bowan.

The entertainment of the day was furnished by the Western Electric Company, it being ladies' day. A Western Electric Hughes hot plate presented by the Hughes Electric Company, was given as a prize for the ladies, Mrs. J. P. Hart, being the lucky lady to draw the prize.

The chairman of the day was Mr. W. H. P. Hill, who introduced Mr. F. M. Cooley, coast selling agent for the Hughes Range, who gave a short talk on the Hughes electric range. One of the No. 50 Western Electric Hughes ranges being set up in the dining room. He also announced that the Portland Railway, Light & Power Company had granted a 3 cent per kw.-hr. rate for electric cooking.

The next speaker was Mrs. Elinor Meacham Reddington who spoke on "Electric Cooking." Samples of the cake baked on an electric range were served at the luncheon. She stated that electric cooking was more healthful than gas and that a housewife could save at least three hours a day cooking on an electric range, over a gas range. She also stated that in Billings, Montana, that there were 800 Hughes ranges installed, the bill for power averaging $2 to $3 per month per range, with a rate of 3 cents per kw.-hr. The last speaker of the day was W. L. Overman of the Hughes Factory, who read a short paper on the future of the cooking industry. He said in Winnipeg, Canada, that there were 3000 Hughes ranges in operation, on a 1 cent per kw.-hr. basis, and the average cost of power was $2 per month per range. Attendance 76.

TRADE NOTES.

The Western Electric Works is installing a new electrical system in the Failing Estate Building, 80 Front street, Portland. This building was recently badly damaged by fire.

Vanderlip & Lord of Portland have obtained the contract for installing the electrical system in the new store of the Wonder Millinery Company, 134 Sixth street, Portland, Oregon.

The General Electric Construction Company, San Francisco, has taken quarters at Mason and O'Farrell streets, San Francisco, where they intend to operate a retail electrical supply store as well as a general contracting business.

The Morrison Electric Company of Portland, Oregon, has received the contract for the electric system in the five-story brick building being built for O. E. Heintz at 9 East Third street North.

The Tacoma Dredging Company is constructing a new 24 in. suction dredge, which is to be electrically equipped. Mr. J. B. C. Lockwood, consulting engineer of Portland, Ore., is consulting engineer for the company and will supervise the installation.

Kieruiff & Co., dealers in electrical and industrial equipment at Los Angeles, have been granted permission by the Superior Court to change their name (B. F. Kieruiff Jr. & Co.) to the style of Kieruiff & Company, the change having been effected on account of the old style being long and cumbersome and the fact that B. F. Kieruiff Sr. is deceased.

The Westinghouse Electric & Manufacturing Company, Northwestern Bank Building, Portland, secured an order from the Crown-Willamette Paper Company, Oregon City, for one 1250 k.v.a. turbine generator, and a 6-panel switchboard for control of three generators and several feeders and transformer banks. Another order placed was a switchboard for the Northwestern Electric Company's Pittock and Albina substation equipment.

W. A. Kraner & Company of Portland have the contract for the penstocks in connection with the 15,000 horsepower hydroelectric development of the Utah Light & Power Company at Grace, Idaho. The contract will include the erection of 1000 tons of plate steel, 7½ ft. in diameter, penstocks to operate under a 500 ft. headway, and for the installation of a butterfly gate valve, Y's, etc. Work on the project will be started immediately.

W. A. Kramer & Company of Portland, Oregon, have obtained the contract for the equipment of the new 53 apartment house being erected for Wessell & Company at 581 Couch street, Portland, Oregon. This apartment house is to be equipped throughout with the Hughes electric ranges. The following are the various sizes purchased: Eight apartments to have No. 50, 25 apartments to have No. 44, and 20 apartments to have No. 33.

NEWS OF THE IDAHO PUBLIC SERVICE COMMISSION.

The commission has ordered dismissal of the complaint of the Cottonwood Milling Company, that the service of the Grangeville Electric Light & Power Company is inadequate, irregular and insufficient. With regard to the charge that the rates are unjust, unreasonable and excessive, the commission has ordered that a test be made of the mill company's 50 h.p. motor by an electrical engineer to determine the minimum charge under the power company's schedule for mill purposes.

The commission has permitted the Washington Water Power Company to construct a proposed transmission line near Burke, Idaho, in accordance with plans which do not conform with the Commission's General Order No. 10, governing line construction. The configuration of the ground over which it is desired to construct proposed transmission lines is such that to follow out strictly the instructions as set forth in General Order No. 10, would be a physical impossibility, and that in order to have said proposed transmission lines cross over Canyon Creek it will be necessary to have one single span of approximately 435.3 ft. in length.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Western States Gas & Electric Company has filed an application with the commission, requesting authority to issue $266,000 of bonds at not less than 85 per cent, of their face value and accrued interest. The company has also applied for authority to sell $33,000 of its six per cent notes at not less than 93 per cent of their face value, plus accrued interest. These notes are a portion of an issue of $1,050,000 of notes which the company was previously authorized to issue at par.

The commission has issued an order authorizing Ross B. Watkins to sell the Sanger Telephone Company, operating in the town of Sanger, Fresno county, to H. F. Knapp for the sum of $11,000.

The commission has issued a supplemental order authorizing the Oceanside Electric & Gas Company to issue $12,442 of promissory notes, payable on demand.

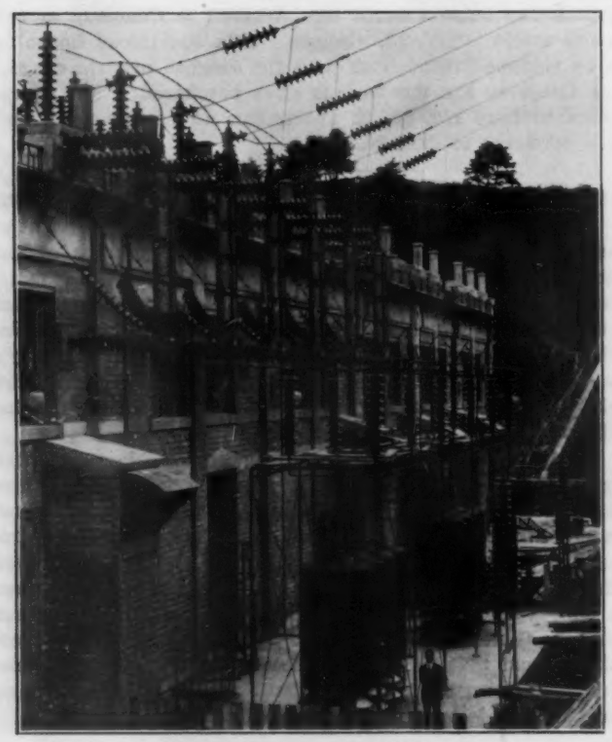
The Southern Sierras Power Company, operating in Inyo, Kern, Riverside and San Bernardino counties, has filed an application with the commission, requesting authority to issue three promissory notes in the sum of $25,000 each, for the purpose of refunding similar notes now outstanding. The company asks for permission to secure these notes by pledge of an equal amount of first mortgage bonds.

INDUSTRIAL

HIGH TENSION TRANSFORMERS AND CIRCUIT BREAKERS FOR JAPANESE HYDROELECTRIC PLANT.

The largest single order for high voltage transformers, 6600/115,000 volts, is probably that placed with the Westinghouse Electric & Manufacturing Company by the Inawashiro Hydroelectric Power Company of Japan, for its No. 1 power house on the Nippashi River and its main substation at Tokio, 140 miles away. Twelve 4400 k.v.a. units were installed at the power house and twelve 4000 k.v.a. units at the substation.

These transformers were all single phase, 50 cycle, oil insulated, water cooled, the 4400 k.v.a. being used in banks



Outgoing 115,000 Volt Lines and Lightning Arresters.

of three for stepping up from 6600 volts delta to 115,000 volts delta and the 4000 k.v.a. being used in banks of three for stepping down from 100,000 volts to 11,000 volts delta.

As the transformers and all other equipment for the power plant were shipped over the Imperial Japanese Railway, whose gauge is 3 ft. 6 in., a space limitation of 18 ft. length, 8 ft. 9 in. width and 7 ft. height, necessitated a slight distortion in the design of the transformer tank.

The efficiency of the 4400 k.v.a. transformers is 98.6 per cent at full load, and the regulation 1.05 per cent for 100 per cent power factor.

One of the most important features of these transformers, as well as the circuit breakers and lightning arresters, is the condenser type terminal developed to take current at extremely high voltages through a metallic cover into the tank containing the oil immersed apparatus.

These terminals consist of a rod or tube forming the conductor which is surrounded by a number of concentric condensers of predetermined capacity connected in series so that the fall of static potential from the inner one forming the line conductor to the outer one which is grounded is such as not to strain the insulating material beyond its dielectric strength. These terminals are made by winding micarta paper coated with a specially prepared shellac under a heavy pressure and at a high temperature around the conductor. The various layers are built up by machinery which heats and sticks the layers together automatically, so that the tube when completed is virtually one solid mass.

The 115,000 volt indoor type oil circuit breakers are of the floor mounting type arranged for solenoid operation. Each pole of the breaker is located in its welded steel tank with a treated lining and is complete with all of its mechanism on its cast iron top. Each pole being entirely independent with the operating rod forming the only connection

115,000 Volt Busbars and Oil Switches.

between adjacent holes, the spacing of these poles can be altered to suit the station wiring.

The operating mechanism for each pole consists of a toggle actuating a simple system of levers and links with the pull rod connecting the poles so that all open and close with the same movement and so that all adjustments can be made after the mechanism has been assembled on the cover and before the latter is placed in the oil tanks. This breaker has its stationary contacts screwed directly on the end of the brass tubes which form the leads through the condenser bushing and they are deeply immersed in oil. The movable contacts are self aligning and the arcing contacts both stationary and movable, are readily renewable.

The cover is securely bolted to a flange riveted to the upper edge of the tank by loosening four bolts and taking cover off ample space is available for removal of contacts and mechanism. The condenser bushing leads which form the stationary terminal can readily be unclamped and removed through the cover. Series transformers for the operation of ammeters and relays are clamped directly around the condenser bushing leads inside the tank. Such an arrangement permits the use of a simple compact, and fairly cheap form of current transformer for this service.

NEW CATALOGUES.

The Electric Railway & Manufacturers' Supply Company has issued a new 1915 catalogue which includes the full line of Westinghouse products of which they recently have been appointed agent representatives.

NEWS NOTES

FINANCIAL.

SEATTLE, WASH.—The State Board of Finance has received notice that its bid for the Ellensburg, Wash., $60,000 municipal light bond issue has been accepted.

LOS ANGELES, CAL.—A special meeting of stockholders of San Joaquin Light & Power Corporation has been called for July 19 for the purpose of considering the question of creating the indebtedness of the corporation for $954,000 to be represented by two year 6 per cent collateral trust gold notes, dated August 1, 1915.

OAKLAND, CAL.—The Oakland, Antioch & Eastern Railway is trying to tide over the recent stringency by two agreements, one with the bondholders and the other with the stockholders. The bondholders are to deposit with the Union Trust Company the interest coupons which mature in 1915, 1916 and 1917 and the company is to deposit bonds with the Trust Company, which at 80 will equal the amount of the face of the coupons. The stockholders will pay $3 a share to the trustee, the payments extending over 1915 and 1916.

ILLUMINATION.

GILROY, CAL.—The election for the establishment of a lighting district at San Martin carried last week.

COLUSA, CAL.—Bids will be received up to July 7th for installing a lighting system in the Williams Lighting District.

TEHACHAPI, CAL.—A revised bid for the construction of a lighting system was submitted by J. W. Finch & Company of Los Angeles at $9000.

SEASIDE, ORE.—The mayor has been authorized by the council to enter into a contract with the light company for a system of streamer lights for the entire length of Broadway.

WALLACE, IDAHO.—The council has granted a franchise for a gas plant to John H. Wourms and associates. Actual work is to commence within six months. The plant is to be completed within a year.

SANTA MONICA, CAL.—When bids were opened for an ornamental lighting system on Ashland avenue, D. S. McEwen was found to be the lowest bidder at $1275. All bids were referred to City Engineer Morton.

LOYALTON, CAL.—A special election will be held here on July 12th for the purpose of submitting the proposition of incurring a bonded indebtedness of $5000 for the construction of an electric light and power plant.

CORONA, CAL.—Trustees Mueller and Willits have been appointed to investigate lighting rates. A municipal light plant is to be considered. The cost of establishing such a plant will be presented at an early meeting of the trustees.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company has made application to the supervisors to transfer to the Pacific Light & Power Corporation its contract for a lighting system in the Miramonto and Florence Lighting District.

EUGENE, ORE.—This city is considering the installation of a 1250 kw. steam-electric power plant as an auxiliary to the existing municipal plant of two 700 kw. generators on McKenzie River. Plans, specifications and estimates are before the officials tentatively.

BEND, ORE.—Citizens will vote August 9th on the question of allowing another light and power company to enter the field. The council passed an ordinance granting a franchise to the Steidl-Tweet Company the mayor vetoed it, and the council passed it over his veto.

MADERA, CAL.—J. H. Beals, foreman of the Madera gas works, has sold his interest in the plant to Geo. W. Kitchen, president of the company. Mr. Beals, who installed the plant at Madera, and who has been in charge of the plant most of the time, will leave soon for Colorado, where he had charge of an important plant for a year before returning to Madera last spring. He also expects to look over the possibilities of a gas plant at Tracy. He is considering putting in a plant for that city.

TRANSMISSION.

CENTRALIA, WASH.—The county commissioners have granted a franchise to C. O. Smith to extend the service of the Morton Electric Company over all roads leading out of Morton.

EL PASO, TEX.—Work of securing data as to the feasibility of installing a power plant at Elephant Butte dam is under way. The work is in charge of O. H. Ensign, chief electrical engineer.

BOISE, IDAHO.—The Utah Construction Company, owners of the Big Lost River Irrigation project, has decided to replace the Mackay dam with a new structure. Engineers of the company have already figured the estimates.

PORT ANGELES, WASH.—A franchise has been granted to J. L. Keeler, Sequim, permitting erection and operation of a transmission line for the distribution of electrical energy for light and power purposes along the highways between Sequim, Dungeness and Port Williams.

IDAHO FALLS, IDAHO.—Ralph Edmonds and Barzilla Clarke of this city have applied for a seven year franchise for the town of Arco to install and operate an electric light, power and water plant at that place. At the end of seven years the plant is to be turned over to the town at the price to be agreed on by the commission.

TUCSON, ARIZ.—Recent action of the Department of Agriculture has advanced the day when the dam may be built in Sabino Canyon to develop water power. The department has granted options to three companies for taking out permits to make preliminary surveys. The New State Development Company has prior right subject to validity of the congressional grant of the Pima Land & Water Company, Federal Power & Water Company has second right, and John W. Daily has third right, the two latter also depending upon the validity of the Pima Land & Water Company's grant.

TRANSPORTATION.

ALAMEDA, CAL.—At a recent meeting of the city council it was requested that the San Francisco & Oakland Terminal Railway run cars south to Santa Clara avenue on Webster street to Central avenue. It is probable that the new track will be installed and cars run direct from Oakland to the baths.

TURLOCK, CAL.—The Tidewater Southern Railroad has decided to postpone its extension to Turlock until such time as the supervisors of Stanislaus county will regulate the interurban jitneys. The railroad company asked that jitneys be compelled to carry $5000 compensation insurance, go over regular routes and pay 8 per cent of the gross receipts to the county. The supervisors refused.

TELEPHONE AND TELEGRAPH.

DOUGLAS, ARIZ.—At a meeting of the Homesteaders' Association of the Sulphur Springs Valley, the subject of a rural telephone line for the Light and Ash creek districts, was discussed by Mr. Adams of the New State Telephone & Telegraph Company.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Works of National Carbon Co.... Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Baruch Electric Controller Corporation..... 111-117 Kearny Street, San Francisco.

B-2 Benjamin Electric Manufacturing Co..... 590 Howard Street, San Francisco

B-3 Blake Signal and Manufacturing Co..... 680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co..... 4 (See Pierson, Roeding & Co.)

B-6 Berkeley Electric Cooker Co..... 1932 Center Street, Berkeley.

B 7 Busch-Sulzer Bros.-Diesel Engine Co..... 5 Rialto Bldg., San Francisco.

C-1 Century Electric Co..... 5 614 South Grand Avenue, Los Angeles; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-3 Crocker-Wheeler Co..... Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-4 Cutler-Hammer Manufacturing Co..... 579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 D. & W. Fuse Co..... 12 Western Electric Co.

D-2 Dearborn Drug and Chemical Works..... 5 355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

D-3 Dover Manufacturing Co..... Canal Dover, Ohio.

E-1 Edison Lamp Works of General Electric Co..... Rialto Bldg., San Francisco.

E-2 Edison Storage Battery Supply Co..... 5 441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co..... 247 Minna Street, San Francisco; Central Building, Los Angeles.

E-4 Electric Storage Battery Co..... 3 Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; 118 New Montgomery Street, San Francisco; Colman Bldg., Seattle.

E-5 Electric, Railway & Manufacturers Supply Co..... 12 84 Second Street, San Francisco.

F-1 Fairbanks, Morse & Co..... Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co..... Rialto Bldg., San Francisco; Colman Bldg., Seattle.

G-1 General Electric Co..... 10 124 W. Fourth Street, Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-2 General Vehicle Co..... 1117 Van Ness Avenue, San Francisco; 331 Wall Street, Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C.

H-1 Habirshaw Wire Co..... (See Western Electric Company.)

H-2 Hemingray Glass Co..... 5 330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-5 Hunt, Mirk & Co..... 141 Second Street, San Francisco.

H-6 Hubbard & Co..... Rialto Bldg., San Francisco.

I-1 Indiana Rubber and Insulated Wire Co..... 3 Fobes Supply Co., Portland and Seattle.

K-1 Kellogg Switchboard and Supply Co..... 4 Aronson Bldg., San Francisco.

K-2 M. W. Kellogg Co..... (See Pierson, Roeding & Co.)

L-1 Leahy Manufacturing Co..... Eighth and Alameda Street, Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 4 (See Pierson, Roeding & Co.)

M-2 McGlauflin Manufacturing Co..... Sunnyvale, Cal.

M-4 Morse Chain Co..... 6 Monadnock Bldg., San Francisco.

M-3 Moore & Co., Charles C..... 3 Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 Nason & Co., R. N..... 151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The..... Trust and Savings Bldg., Los Angeels; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co..... (All Jobbers.)

N-4 New York Insulated Wire Co..... 5 629 Howard Street, San Francisco.

O-1 Okonite Co. (The) ..... 12 (All Jobbers.)

P-1 Pacific Electric Manufacturing Co..... 80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co..... 2 236-240 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 200-210 12th Street, Oakland; 575 Mission Street, San Francisco; 307 First Avenue, So., Seattle.

P-4 Pelton Water Wheel Co..... 5 2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co..... 4 Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-7 Pittsburgh Piping & Equipment Co..... 12 Monadnock Bldg., San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The..... 5 211 J Street, Sacramento; 356 Market Street, San Francisco.

S-3 Simplex Electric Heating Co..... 12 612 Howard Street, San Francisco.

S-4 Southern Pacific Co..... 2 Flood Bldg., San Francisco.

S-5 Sprague Electric Works..... 12 Rialto Bldg, San Francisco; Colman Bldg.; Seattle; 124 West 4th Street, Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 Standard Underground Cable Co..... 5 First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 Thomas & Co., R..... (See Western Electric Co.)

W-1 Wagner Electric Manufacturing Co..... 3 Rialto Bldg., San Francisco.

W-2 Western Electric Co..... 8th and Santee Streets, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 907 First Avenue, Seattle; 45 North Fifth Street, Portland, Ore.

W-4 Westinghouse Electric and Manufacturing Co..... 50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Second and Cherry Streets, Seattle; Paulsen Bldg., Spokane.

W-5 Westinghouse Machine Co..... 141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co..... (See Westinghouse Electric and Manufacturing Co.)

W-8 Western Pipe & Steel Co..... 444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.